

Precalc 10.5

Use and determine standard and general forms of the equation of a parabola
Graph parabolas

parent graph $y=x^2$

$$x^2=y \quad y^2=x$$

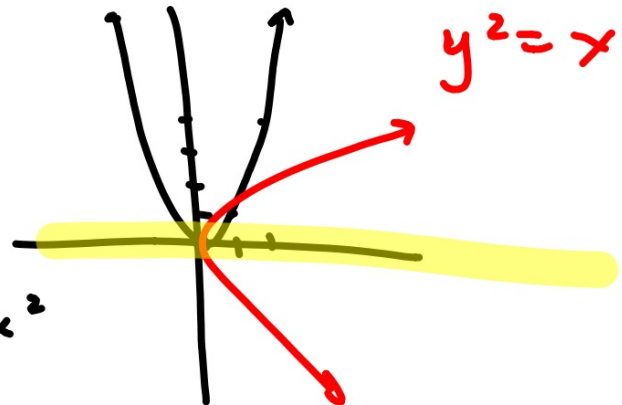
p
focus (x,y)
directrix
axis of symmetry
vertex
latus rectum

eccentricity

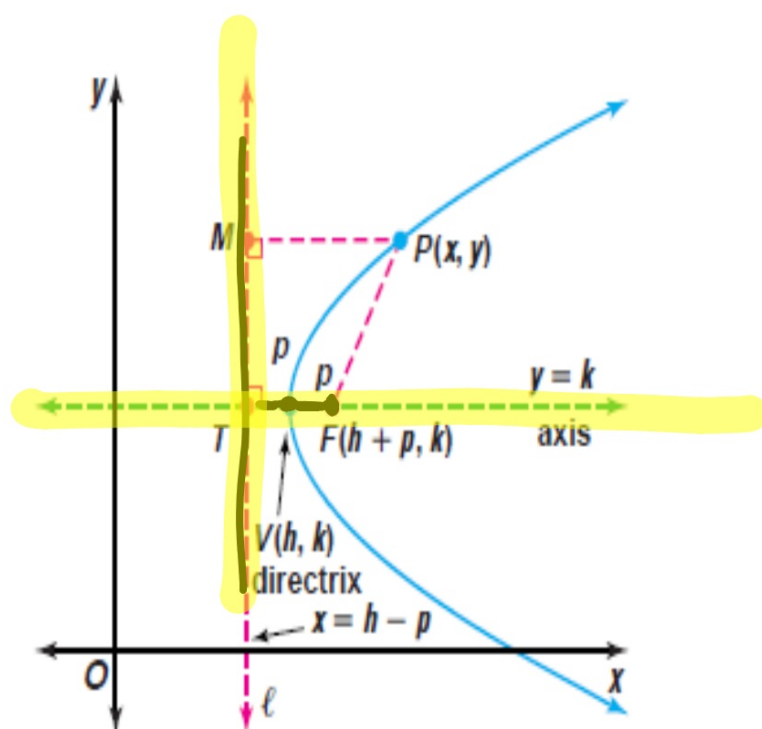
light bulbs

$$y=-x^2$$

$$y^2=x$$



<https://www.youtube.com/watch?v=Vq7xXUaCDI4>



p (parabola constant)



$$x^2 = 4py$$

$$\text{or } y^2 = 4px$$



For the equation of each parabola, find the coordinates of the vertex and focus, and the equations of the directrix and axis of symmetry. Then graph the equation.

$$6. x^2 = 12(y - 1)$$

$$x^2 = 4py$$

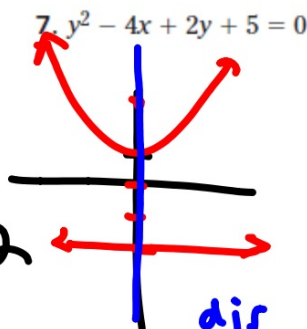
$$4p = 12$$

$$p = 3$$

$$V(0, 1)$$

$$F(0, 4)$$

$$\text{dir } y = -2$$



$$7. y^2 - 4x + 2y + 5 = 0$$

$$8. x^2 + 8x + 4y + 8 = 0$$

$$y^2 = 4px$$

$$y^2 + 2y + 1 = 4x - 5 + 1$$

$$(y + 1)^2 = 4(x - 1)$$

$$\text{AOS } x = 0$$

Standard form or...

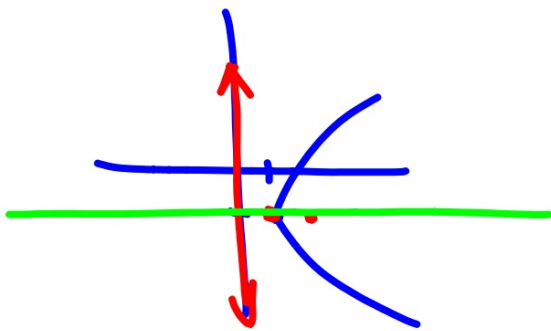
Complete the square...

$$x^2 =$$

$$y^2 =$$

$$y^2 = 4py$$

$$(y+1)^2 = \textcircled{4}(x-1)$$



$$F (2, -1)$$

$$V (1, -1)$$

$$\text{A.O.S } y = -1$$

$$\text{dir } x = 0$$

$$p = 1$$

$$x^2 = 4py$$

$$x^2 + 8x + 4y + 8 = 0$$

$$V (-4, 2)$$

$$F (-4, 1)$$

$$\text{dir } y = 3$$

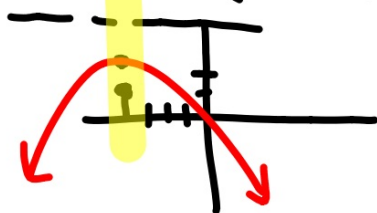
$$\text{AOS}$$

$$x = -4$$

$$x^2 + 8x + 16 = -4y - \underbrace{8 + 16}_{+8}$$

$$(x + 4)^2 = -4(y - 2)$$

$$p = 1$$



**General Form
for the
Equation of
a Parabola**

The general form of the equation of a parabola is
 $y^2 + Dx + Ey + F = 0$, when the directrix is parallel to the y -axis, or
 $x^2 + Dx + Ey + F = 0$, when the directrix is parallel to the x -axis.

$$x^2 = 4py$$

$$18. x^2 + 10x + 25 = -8y + 24$$

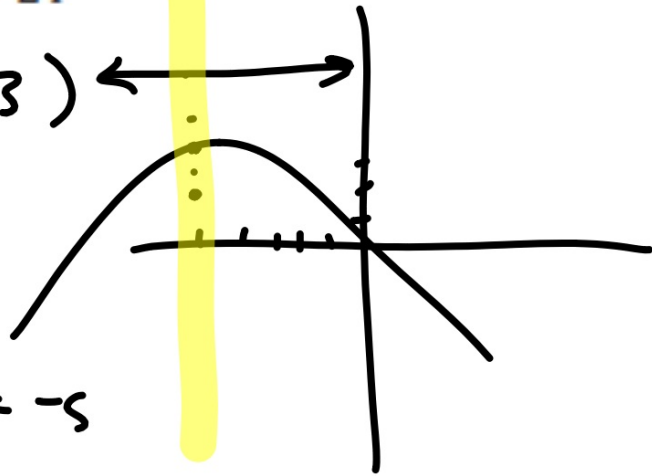
$$(x+5)^2 = -8(y-3)$$

$$\frac{4p}{1} = -\frac{8}{4}$$

$$V(-5, 3)$$

$$F(-5, 1) \text{ Axis } x = -5$$

$$\text{dir } y = 5$$



$$x^2 = 4py$$

3 Consider the equation $2x^2 - 8x + y + 6 = 0$.

- Write the equation in standard form.
- Find the coordinates of the vertex and focus and the equations for the directrix and the axis of symmetry.
- Graph the equation of the parabola.

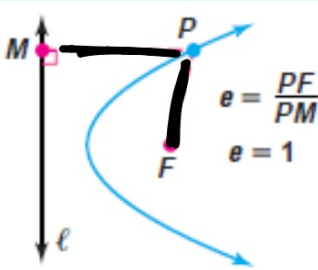
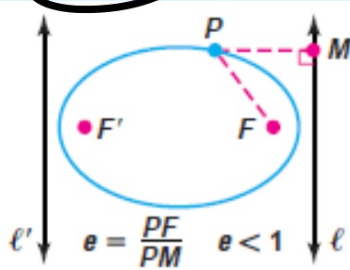
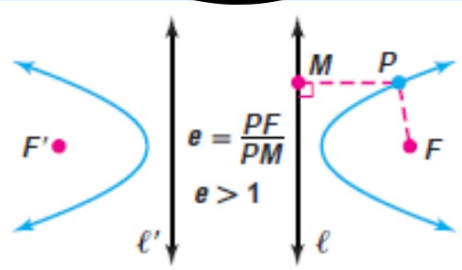
$$2(x^2 - 4x + 4) = -y - 6 + 8$$

$$\underline{2}(x-2)^2 = \underline{-1}(y-2)$$

factor
complete the square
solve for $x^2 = 4py$

$$(x-2)^2 = -\frac{1}{2}(y-2)$$

$$\frac{4p}{4} = -\frac{1}{2} \quad p = -\frac{1}{8}$$

parabola	ellipse	hyperbola
$e = 1$	$e < 1, e \neq 0$	$e > 1$
 $e = \frac{PF}{PM}$ $e = 1$	 $e = \frac{PF}{PM}$ $e < 1$	 $e = \frac{PF}{PM}$ $e > 1$

$e =$
 L.R. 4p

Write the equation of the parabola that meets each set of conditions. Then graph the equation.

9. The vertex is at the origin, and the focus is at $(0, -4)$.

If you can determine p , the problem will unravel from there.

p =distance:
vertex to focus=vertex to directrix

hint: always sketch first

Write the equation:

10. The parabola passes through the point at $(2, -1)$, has its vertex at $(-7, 5)$, and opens to the right.

What is the sign
of p ?

Consider $x^2 =$ and $y^2 =$ equations. Which one is a function?

1 Consider the equation $y^2 = 8x + 48$.

- a. Find the coordinates of the focus and the vertex and the equations of the directrix and the axis of symmetry.
- b. Graph the equation of the parabola.

factor to find p